

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

1. (Currently amended) A heat-shrinkable polyester film made by a process comprising at least two drawing stages in the maximum shrinkage direction,
wherein the first stage of drawing is performed at a first temperature that is from 5°C below Tg to 15°C above Tg and at a first drawing ratio of between 4.4 and 6.0; and
wherein the second stage of drawing is performed at a second temperature that is identical to or about 1 to about 5°C lower than the first temperature and at a second drawing ratio of between 1.1 and 1.5,

wherein the film satisfies satisfying the following requirements (A) to (E):

(A) a the heat shrinkage percentage in a maximum shrinkage direction of the film a sample is 10% to 50%, wherein, the sample is prepared and treated when measured under following conditions:

a the heat shrinkable polyester film is cut into a shape of a square measuring 10 cm × 10 cm;

the sample square obtained is immersed in hot water at 70°C for 5 seconds and then withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(B) a the heat shrinkage percentage of a sample in a maximum shrinkage direction of the film is not less than 75%, and a heat shrinkage percentage in a direction orthogonal to the maximum shrinkage direction is not more than 10%,

wherein, the sample is prepared and treated when measured under the following conditions:

a the heat shrinkable polyester film is cut into a shape of a square measuring 10 cm × 10 cm;

the sample square obtained is immersed in hot water at 85°C for 5 seconds and then

withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(C) a the heat shrinkage percentage difference of a sample the film ΔX (%) represented by a following equation is 10% to 20%,

$$\Delta X = X_0 - X_{10}$$

wherein, X_0 and X_{10} are defined as follows; X_0 : a is the heat shrinkage percentage in a maximum shrinkage direction of the film a sample obtained by cutting a heat shrinkable polyester film into a shape of a square measuring 10 cm × 10 cm; and X_{10} : a is the heat shrinkage percentage in a maximum shrinkage direction of a film obtained by cutting a heat shrinkable polyester the film having after it has experienced a 10% heat shrinkage by 10% in a maximum shrinkage direction; and

wherein[[],] each of X_0 and X_{10} is measured under the following conditions:

the film to be measured is cut into a square measuring 10 cm × 10 cm;

the sample square obtained is immersed in hot water at 95°C for 5 seconds and then withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(D) a the three-dimensional surface roughness $S\Delta a$ is 0.008 to 0.04;

(E) a the three-dimensional surface roughness SR_z is 0.6 to 1.5 μm .

2. (Currently amended) A heat-shrinkable polyester film made by a process comprising at least two drawing stages in the maximum shrinkage direction,

wherein the first stage of drawing is performed at a first temperature that is within the range of 5°C below T_g to 15°C above T_g and at a first drawing ratio of between 4.4 and 6.0; and

wherein the second stage of drawing is performed at a second temperature that is identical to or about 1 to about 5°C lower than the first temperature and at a second drawing ratio of between 1.1 and 1.5,

wherein the film satisfies satisfying the following requirements (A) to (C), (F), and (G):

(A) a the heat shrinkage percentage in a maximum shrinkage direction of the film a sample is 10% to 50%, wherein, the sample is prepared and treated when measured under

following conditions:

a ~~the heat shrinkable polyester film~~ is cut into a shape of a square measuring 10 cm × 10 cm;

the ~~sample square~~ obtained is immersed in hot water at 70°C for 5 seconds and then withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(B) a ~~the heat shrinkage percentage of a sample in a maximum shrinkage direction of the film is not less than 75%, and a heat shrinkage percentage in a direction orthogonal to the maximum shrinkage direction is not more than 10%,~~

~~wherein, the sample is prepared and treated when measured under following conditions:~~

a ~~the heat shrinkable polyester film~~ is cut into a shape of a square measuring 10 cm × 10 cm;

the ~~sample square~~ obtained is immersed in hot water at 85°C for 5 seconds and then withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(C) a ~~the heat shrinkage percentage difference of a sample the film ΔX (%) represented by a following equation is 10% to 20%,~~

$$\Delta X = X_0 - X_{10}$$

~~wherein, X_0 and X_{10} are defined as follows; X_0 is the heat shrinkage percentage in a maximum shrinkage direction of the film a sample obtained by cutting a heat shrinkable polyester film into a shape of a square measuring 10 cm × 10 cm; and X_{10} is the heat shrinkage percentage in a maximum shrinkage direction of a film obtained by cutting a heat shrinkable polyester the film having after it has experienced a 10% heat shrinkage by 10% in a maximum shrinkage direction; and~~

~~wherein[[],] each of X_0 and X_{10} is measured under the following conditions:~~

~~the film to be measured is cut into a square measuring 10 cm × 10 cm;~~

the ~~sample square~~ obtained is immersed in hot water at 95°C for 5 seconds and then withdrawn from the hot water, and subsequently is immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

(F) a ~~the~~ light transmission at a wavelength of 380 nm is not more than 20%, and a ~~the~~

light transmission at a wavelength of 400 nm is not more than 60%;

(G) a the Hhaze value is not more than 15%.

3. (Currently amended) A film roll of a heat-shrinkable polyester film having a length of 1000 to 6000 m, wherein the film is made by a process comprising at least two drawing stages in the maximum shrinkage direction,

wherein the first stage of drawing is performed at a first temperature that is within the range of 5°C below Tg to 15°C above Tg and at a first drawing ratio of between 4.4 and 6.0; and
wherein the second stage of drawing is performed at a second temperature that is identical to or about 1 to about 5°C lower than the first temperature and at a second drawing ratio of between 1.1 and 1.5,

wherein the heat shrinkable polyester film satisfies~~y~~ing the following requirements (a) to (c):

(a) an the average of heat shrinkage percentages in a maximum shrinkage direction of the film samples is 10% to 50%, when measured under the following conditions wherein, the samples are obtained in a following manner:

a first plurality of samples each measuring 10 cm × 10 cm are cut from the film at a plurality of sample cut-off points, wherein

an initiation end of winding of a film of steady region giving stable film properties in a longitudinal direction is defined as a first end, and a termination end of winding thereof is defined as a second end;

a first cut-off point of the samples of the film is provided less than 2 m inside of the second end, and a final cut-off point is provided less than 2 m inside the first end;

a the plurality of sample cut-off points are provided at an interval of about 100 m from the first cut-off point, and the samples are obtained by cutting into a shape of a square measuring 10 cm × 10 cm at each sample cut-off point; and

wherein the samples are treated in a following manner:

the first plurality of samples obtained are immersed in hot water at 70°C for 5 seconds and then withdrawn from the hot water, and subsequently immersed in water at 25°C for 10 seconds, and then withdrawn from the water; and

the heat shrinkage percentages in a maximum shrinkage direction of the first plurality of samples are averaged;

(b) an average of heat shrinkage percentages in a maximum shrinkage direction of the film samples is not less than 75%, and a the average heat shrinkage percentage in a direction orthogonal to the maximum shrinkage direction is not more than 10%, when measured under following conditions wherein, the samples are obtained in a following manner:

a second plurality of each samples each in a shape of a square measuring 10 cm × 10 cm is are each separately cut from each cut-off point of the first plurality of samples in the requirement (a);

the second plurality of obtained samples obtained are immersed in hot water at 85°C for 5 seconds, and then withdrawn from the hot water, and subsequently[[,]] immersed in water at 25°C for 10 seconds, and then withdrawn from the water; and

the heat shrinkage percentages in a maximum shrinkage direction of the first plurality of samples are averaged;

(c) a heat shrinkage percentage difference ΔX (%) of each pair of a plurality of sample pairs at all cut-off points of samples represented by following equation is in a range of 10% to 20%,

$$\Delta X = X_0 - X_{10}$$

wherein, X_0 and X_{10} are defined as follows,

X_0 : a heat shrinkage percentage in a maximum shrinkage direction measured for each sample in a shape of a square measuring 10 cm × 10 cm separately cut from each cut-off point of sample in the requirement (a) being immersed for 5 seconds in hot water at 95°C, then withdrawn from the hot water, and subsequently, being immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

X_{10} : a heat shrinkage percentage in a maximum shrinkage direction measured in a same manner for each sample obtained by cutting into a shape of a square measuring 10 cm × 10 cm after shrunk by 10% in a maximum shrinkage direction of a cut sample in a shape of a square measuring 25 cm × 25 cm separately cut from each cut-off point of sample in the requirement (a)

wherein X_0 and X_{10} are measured under the following conditions:

a third plurality of samples each measuring 10 cm × 10 cm are each separately cut from

each cut-off point of the first plurality of samples;

a fourth plurality of samples each measuring 25 cm × 25 cm are each separately cut from each cut-off point of the first plurality of samples;

a fifth plurality of samples each measuring 10 cm × 10 cm are each cut from a sample from the fourth plurality of samples that have experienced a 10% heat shrinkage in a maximum shrinkage direction;

each sample from the third and fifth plurality of samples is immersed for 5 seconds in hot water at 95°C, then withdrawn from the hot water, and subsequently immersed in water at 25°C for 10 seconds, and then withdrawn from the water;

the plurality of sample pairs is formed by pairing each sample from the third plurality of samples with a sample from the fifth plurality of samples originally cut from the same cut-off point; and

X_0 and X_{10} each represents the heat shrinkage percentage in a maximum shrinkage direction of the sample from the third plurality of samples and the sample from the fifth plurality of samples within a sample pair, respectively; and

wherein said film is made by a process comprising drawing the film at a drawing ratio of not less than 4.4 and not more than 6.0 at a temperature within the range of $T_g - 5^\circ\text{C}$ to $T_g + 15^\circ\text{C}$; then heat setting the film with a tension in the drawing direction at a ratio of not less than 1% and not more than 6% at a temperature about 1 to 5°C lower than the first drawing stage temperature; and then drawing the film at a drawing ratio that is not less than 1.1 times and not more than 1.5 times at a temperature that is the same as the heat setting temperature, or is about 1 to 5°C lower than the heat setting temperature.

4. (New) The film of claim 1, wherein the process further comprises heat setting the film with a tension in the drawing direction at a first tension ratio of between 1% and 6% and at a temperature about 1 to 5°C lower than the first drawing stage temperature between the last two drawing stages.

5. (New) The film of claim 4, wherein the first tension ratio is from 2% to 5%.

6. (New) The film of claim 1, wherein the process further comprises cooling the film at a second

tension ratio of between 0.1% and 3% after the last drawing stage.

7. (New) The film of claim 1, wherein the first drawing ratio is from 4.8 to 5.5.

8. (New) The film of claim 1, wherein the second drawing ratio is from 1.1 to 1.3.

9. (New) The film of claim 2, wherein the process further comprises heat setting the film with a tension in the drawing direction at a first tension ratio of between 1% and 6% and at a temperature about 1 to 5°C lower than the first drawing stage temperature between the last two drawing stages.

10. (New) The film of claim 9, wherein the first tension ratio is from 2% to 5%.

11. (New) The film of claim 2, wherein the process further comprises cooling the film at a second tension ratio of between 0.1% and 3% after the last drawing stage.

12. (New) The film of claim 2, wherein the first drawing ratio is from 4.8 to 5.5.

13. (New) The film of claim 2, wherein the second drawing ratio is from 1.1 to 1.3.

14. (New) The film roll of claim 3, wherein the process further comprises heat setting the film with a tension in the drawing direction at a first tension ratio of between 1% and 6% and at a temperature about 1 to 5°C lower than the first drawing stage temperature between the last two drawing stages.

15. (New) The film roll of claim 14, wherein the first tension ratio is from 2% to 5%.

16. (New) The film roll of claim 3, wherein the process further comprises cooling the film at a second tension ratio of between 0.1% and 3% after the last drawing stage.

17. (New) The film roll of claim 3, wherein the first drawing ratio is from 4.8 to 5.5.

18. (New) The film roll of claim 3, wherein the second drawing ratio is from 1.1 to 1.3.